INSTRUCTION BOOK

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FOR

REU-100

RANGE EXTENSION UNIT

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NEMS CLARKE CO.

919 JESUP BLAIR DRIVE • SILVER SPRING, MARYLAND

A DIVISION OF Vitro CORPORATION OF AMERICA

INSTRUCTION BOOK

FOR

REU-100

RANGE EXTENSION UNIT

NEMS-CLARKE COMPANY
919 Jesup Blair Drive
SILVER SPRING, MARYLAND
A Division of Vitro Corporation of America

AHF4881081358

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised while operating this equipment.

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Fig. 1 REU-100 Range Extension Unit, Front View

TABLE 1

PERFORMANCE SPECIFICATIONS

REU–100

Tuning Range	250–475 mcs.
Noise Figure	14 db maximum 10–12 db avg.
Gain	8 db minimum, 10–12 db avg.
I.F. Frequency	60 mcs.
IF Bandwith	3.0 mc. minimum
Image Rejection	40 db minimum
IF Rejection	65 db minimum
Input Impedance	50 Ω, (unbalanced)
Output Impedance	50 to 75 Ω (unbalanced)
Power Consumption	20 watts
Power Input	117/230 volts, 50–60 cps
Weight	15 lbs.

TUBE COMPLEMENT

Symbol	Tube	Function
V–101	OA2	Voltage Regulator
V–201	5842/417A	R.F. Amplifier
V–202	6AK5	Mixer
V–203	6AF4A	Local Oscillator

SECTION 1

GENERAL DESCRIPTION

1. PURPOSE OF EQUIPMENT.

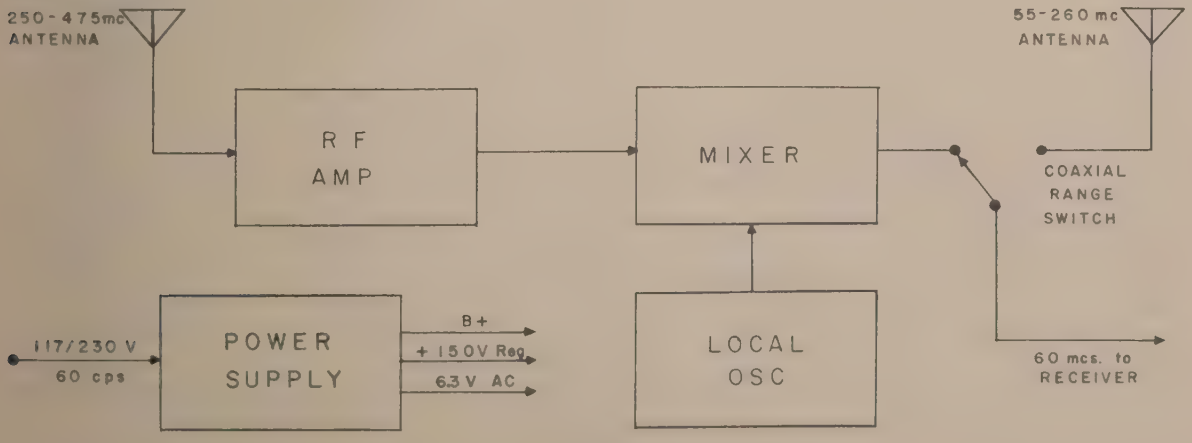
The REU-100 Range Extension Unit has been specifically designed to entend the operating frequency range of the NEMS-CLARKE 55-260 megacycle Special Purpose Receivers having a normal frequency range of 55 to 260 megacycles. The REU-100 tunes continuously from 250-475 megacycles, and will extend the operating range of a receiver to the latter figure, thus offering uninterrupted operation from 55-475 megacycles.

2. DESCRIPTION OF EQUIPMENT.

The front panel controls of the REU-100 consists of the frequency selection knob and indicating dial, the coaxial "Range" switch S-103, the power switch S-101, and the protective line fuse F-101.

The 250-475 mc. antenna coaxial connector J-101, the 55-260 mc. antenna coaxial connector J-106, and the output coaxial connector J-105, are found on the rear apron. The 117/230 v. selector switch S-102, and the 117/230 v. power input jack J-107, are also located on the rear apron.

The REU-100 R.F. section is a completely shielded sub-assembly, featuring great mechanical rigidity and allowing a high degree of electrical stability. Stenciled terminal boards are used in the main chassis to allow central location of components, and to facilitate easy identification. The REU-100 has a 50 Ω coaxial input, and consists of an R.F. amplifier, a local oscillator and a mixer. The unit measures 19 inches wide by 7 inches high by 11-3/4 inches deep, and is designed for standard relay rack mounting. The front panel is finished in hard-finish blue-gray enamel. The weight of the unit is approximately 15 lbs. Fig. 1 shows a front view of the REU-100, and Table 1 shows the Performance Specifications and Tube Complement.



REU—100, RANGE EXTENSION UNIT

Fig. 2 REU-100 Range Extension Unit, Block Diagram

SECTION 2

THEORY OF OPERATION

1. ANALYSIS, Model REU-100.

a. A block diagram of the REU-100 Range Extension Unit is shown in Fig. 2. The circuit with the Range switch, S-103, in the 250-475 mc. position is such that the common output connector, J-105, receives its signal from the output of the mixer at 60 mcs., thus permitting operation in the 250-475 mc. range. With the range switch, S-103, in the direct position, the output connector, J-105 receives its signal from the 55-260 mc. antenna. Continuous tuning is thereby provided from 55-475 mcs., when using the REU-100 in conjunction with a NEMS-CLARKE 55-260 mc. receiver.

2. DETAILED THEORY.

a. Antenna.-- The input impedance of the REU-100 is approximately 50 Ω over the tuning range of 250-475 mcs. The input signal is fed through a type "N" 50 Ω coaxial receptacle, J-101, on the rear apron of the chassis. A type "N" 50 Ω coaxial receptacle, J-106, is provided on the rear apron for the connection of an antenna for use in the 55-260 mc. range.

b. R.F. Amplifier, V-201, 5842/417A. The input signal is applied to the cathode of the grounded-grid R.F. amplifier, V-201. The basic tuning element for the cathode of V-201 is one of four tuning sections of a Mallory UHF Inductuner, L-210A, which broadly resonates the cathode circuit to the frequency of the desired input signal. Cathode resistor method of obtaining self-bias is used in this circuit, the resistor, R-201, developing the bias, and the capacitor, C-214 providing cathode resistor by-passing. The plate circuit of the R.F. amplifier, V-201 is capacitively coupled to the grid of the mixer, V-202, through a double-tuned band-pass circuit, the basic tuning elements of which are two sections of the Mallory UHF Inductuner, L-210B and L-210C.

c. Local Oscillator, V-203/6AF4-A.-- The local oscillator, V-203, which is a modified version of the Colpitts configuration, operates at a frequency of 60 mcs. above the signal input frequency to which the R.F. amplifier is tuned. Maximum oscillator stability is insured by the use of regulated B+ voltage for the oscillator plate circuit. The oscillator signal is injected into the mixer grid circuit through C-206, a 2.7 $\mu\mu$f capacitor, thus developing an operational mixer grid bias proportional to the amplitude of the local oscillator signal.

d. Mixer, V-202/6AK5. -- The mixer V-202 receives the local oscillator injection voltage through C-206, and develops an operational grid bias across the grid resistors, R-204 and R-205. The R.F. signal from the double-tuned band-pass circuit is coupled through the capacitor C-205 to the grid of the mixer. A decoupled test point, from a tap on the mixer grid resistors, R-204 and R-205, provides a means of observing the response of the R.F. circuits and measuring the oscillator injection voltage. Trimmers are incorporated in the R.F. plate, mixer input, and oscillator tank circuits for proper alignment and adjustment. The plate of the mixer, V-202, is tuned to 60 megacycles by L-204, a tunable series coil, and is coupled to the output across a capacitor, C-207, connected to the low R.F. potential end of L-204.

A blocking capacitor, C-219, 470 $\mu\mu$f is provided to prevent application of B+ to the output circuit.

e. Power Supply. -- The power supply may be operated from a source of either 117v or 230v, 60 cps. This is facilitated by the power transformer, T-101, having a tapped primary. Either tap may be utilized by placing the selector switch, S-102 in the proper position. The 0.3 amp. line fuze should be replaced with one having a value of 0.2 amp. when operating unit on a 230v. line. The 117/230 v. line is filtered to prevent entrance of stray radiation at the power input jack, J-107, by capacitors C-102 and C-103.

A conventional full-wave bridge rectifier circuit is employed to supply B+ voltage, using long life silicon junction diodes CR-101 through CR-104. Filtering is provided by a standard capacitor input filter. Regulated +150 v is supplied by a gas regulator tube, V-101, a type OA2. Filament voltage of 6.3 vac is supplied from terminals 8 and 9 of the power transformer secondary.

SECTION 3

INSTALLATION AND OPERATION

1. INTRODUCTION.

Fig. 1 shows the location of the controls on the front panel. Fig. 3 shows the location of the controls and connections on the rear apron.

2. INSTALLATION.

a. Connect the 250-475 mc. antenna through a 50 Ω coaxial transmission line to J-101 on the rear apron, using a type "N" coaxial connector.

b. Connect the 55-260 mc. antenna through a 50 Ω coaxial transmission line to J-106 on the rear apron, using a type "N" coaxial connector.

c. Connect the output connector J-105 to the receiver to be used with the REU-100 through a 50 Ω coaxial transmission line, using a type "N" coaxial connector.

d. Place the 117 v/230 v switch, S-102 in the appropriate position for the supply available.

e. Apply 117 v/230 v, 50-60 cps to J-111 on the rear apron.

3. OPERATION.

a. After the proper adjustments and connections have been made in accordance with the Installation procedures outlined in Section 3-2, turn the power switch, S-101, located on the front panel to the "on" position. The REU-100 should now be ready for operation.

b. Turn the "Range" switch, S-103, to the 250-475 mc. position.

c. Tune the REU-100 to the desired frequency using the frequency selector knob, and indicator dial.

SECTION 4

MAINTENANCE

1. INTRODUCTION.

The REU-100 has been fully aligned and factory tested before shipment and should give relatively trouble-free performance. In the event the unit appears to be unusually noisy, erratic, or to have unusually low sensitivity, check all R.F. coaxial connectors both at the rear apron of the chassis, and at the various antennas. Should this fail to improve the operation of the unit, tube checking may indicate a weak or otherwise faulty tube. The critical nature of UHF circuits is such that field servicing of this equipment is usually limited to vacuum tube replacement. Only a limited number of components in the R.F. subchassis may be replaced without disturbing critically tuned circuits. When replacing components, it is imperative that the new components have leads of identical length with those of the old component, and that the physical location and arrangement of all other components and leads not be disturbed. In the event it becomes absolutely essential to align the REU-100, refer to the following procedure.

2. ALIGNMENT PROCEDURE.

a. Mixer.

1. Connect the output of the REU-100 to a VHF receiver which can be tuned to 60 mc., and which is equipped with an input signal strength meter.

2. Feed a 60 mc. C.W. signal from a signal generator to the grid of the 6AK5 mixer V-202, through the tie-point, TP-101, located on the top of the R.F. sub-chassis.

3. Tune the output coil, L-204 for maximum output as indicated on the VHF receiver signal strength meter.

b. Local Oscillator Adjustment.

1. Local oscillator adjustment is limited to correcting the reading of the tuning dial, if it is found to be in error. The replacement of a tube may produce an error, and this may be corrected for by adjusting C-213. The adjustment should be made with a signal generator with a high degree of accuracy at 475 mc.

2. The low-frequency end of the dial is controlled by the inductance of L-206. The correct adjustment has been made at the factory, and should not require readjustment in the field.

c. R.F. Alignment.

The R.F. circuits are wide band and are designed around a modified Mallory four-section UHF inductuner. If realignment becomes necessary, proceed as follows.

1. Connect a sweep generator with a 50 Ω source impedance to the 250-475 mc. antenna input coaxial connector J-101.

2. Connect a high gain oscilloscope to test point TP-101.

3. Set the tuning dial for 300 mc.

4. Adjust C-211 and C-212 for a double-tuned symmetrical response centered around 300 mc.

NOTE: The R.F. response at the high-frequency end is controlled by fixed inductances and adjustments should not be attempted in the field.

Table 2 shows the Tube Socket Voltage Chart for the REU-100, reference to this chart will be of value in preventative or corrective maintenance.

TABLE 2

TUBE SOCKET VOLTAGE CHART

REU-100 RANGE EXTENSION UNIT

Symbol	Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-101	OA2	150	Gnd	NC	NC	150	NC	NC	–	–
V-201	5842	140	Gnd	Gnd	Gnd	Gnd	1.7	Gnd	Gnd	Ping. 6.4 AC
V-202	6AK5	−1.75	Gnd	6.4AC	Gnd	135	35	Gnd	–	–
V-203	6AF4A	80	−.25	64AC	0	0	−.25	80	–	–

NOTES: (1) Unit set on 475 mc.

(2) Range Switch in 250-475 mc. position.

(3) AC input 117 volts, 60 cps.

(4) Voltage taken with 20,000 Ω per volt meter.

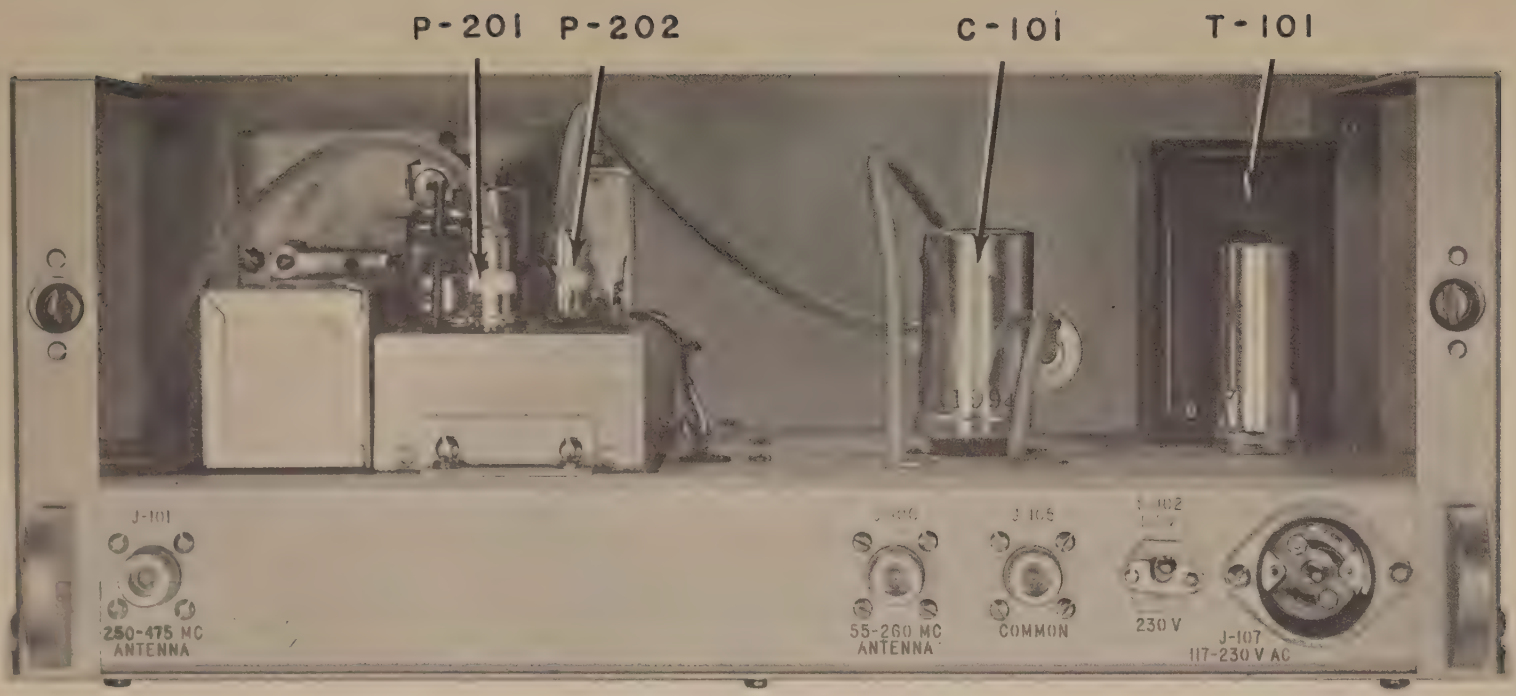


Fig. 3 REU-100 Range Extension Unit, Rear View

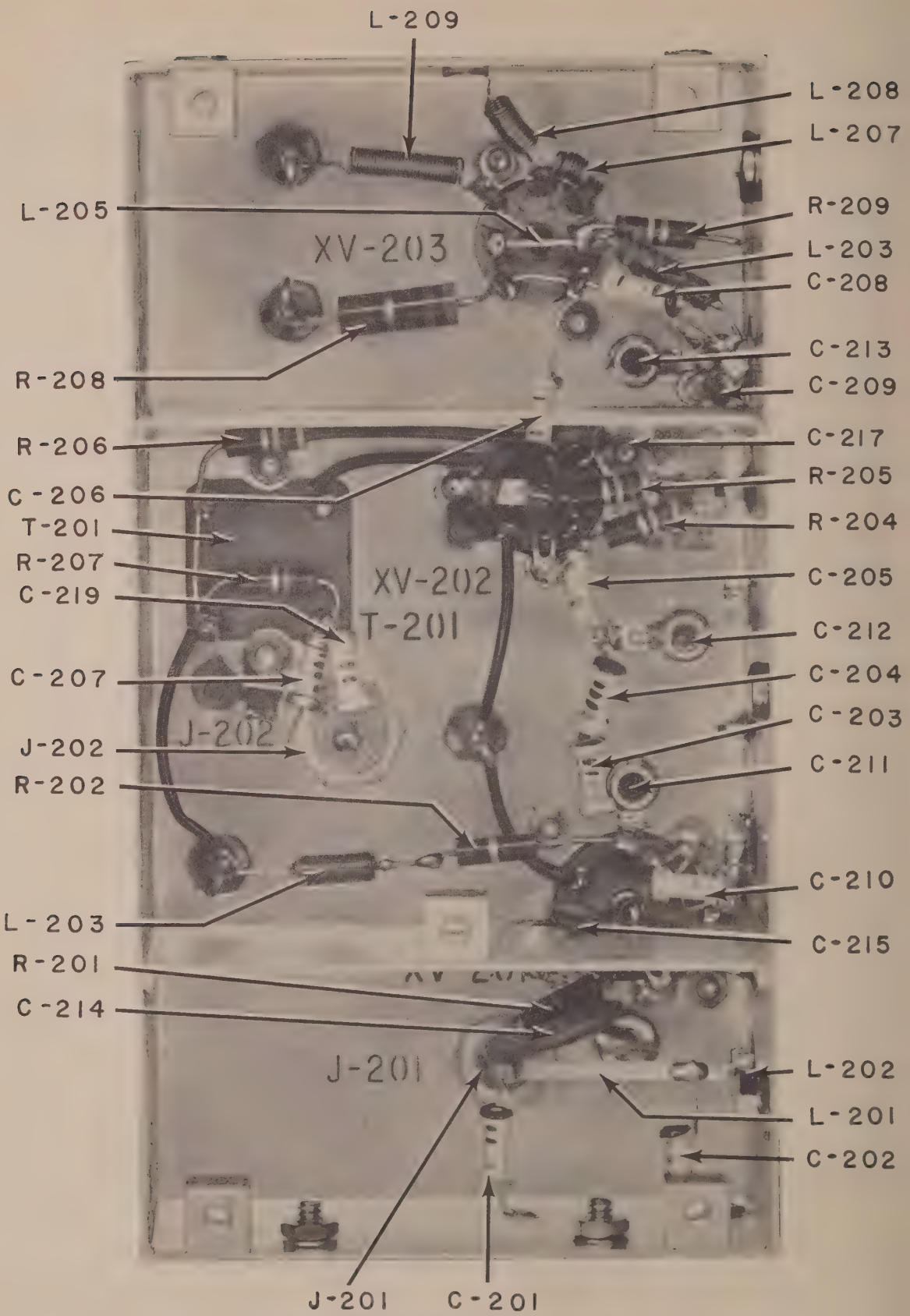


Fig. 4 RF Section, REU-100, Bottom View, Dust Cover Removed

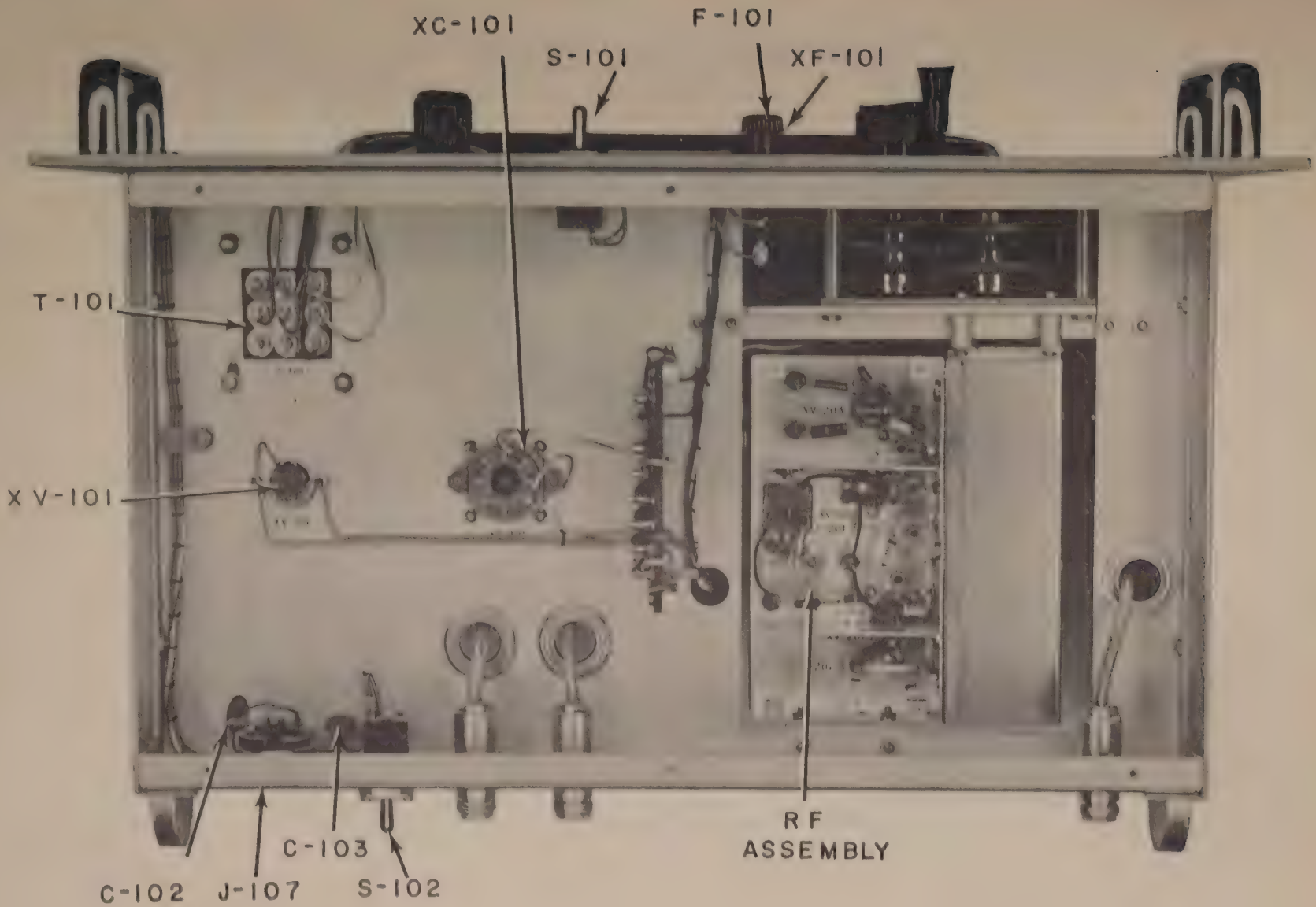


Fig. 5 Main Chassis, REU-100, Bottom View, Dust Cover Removed

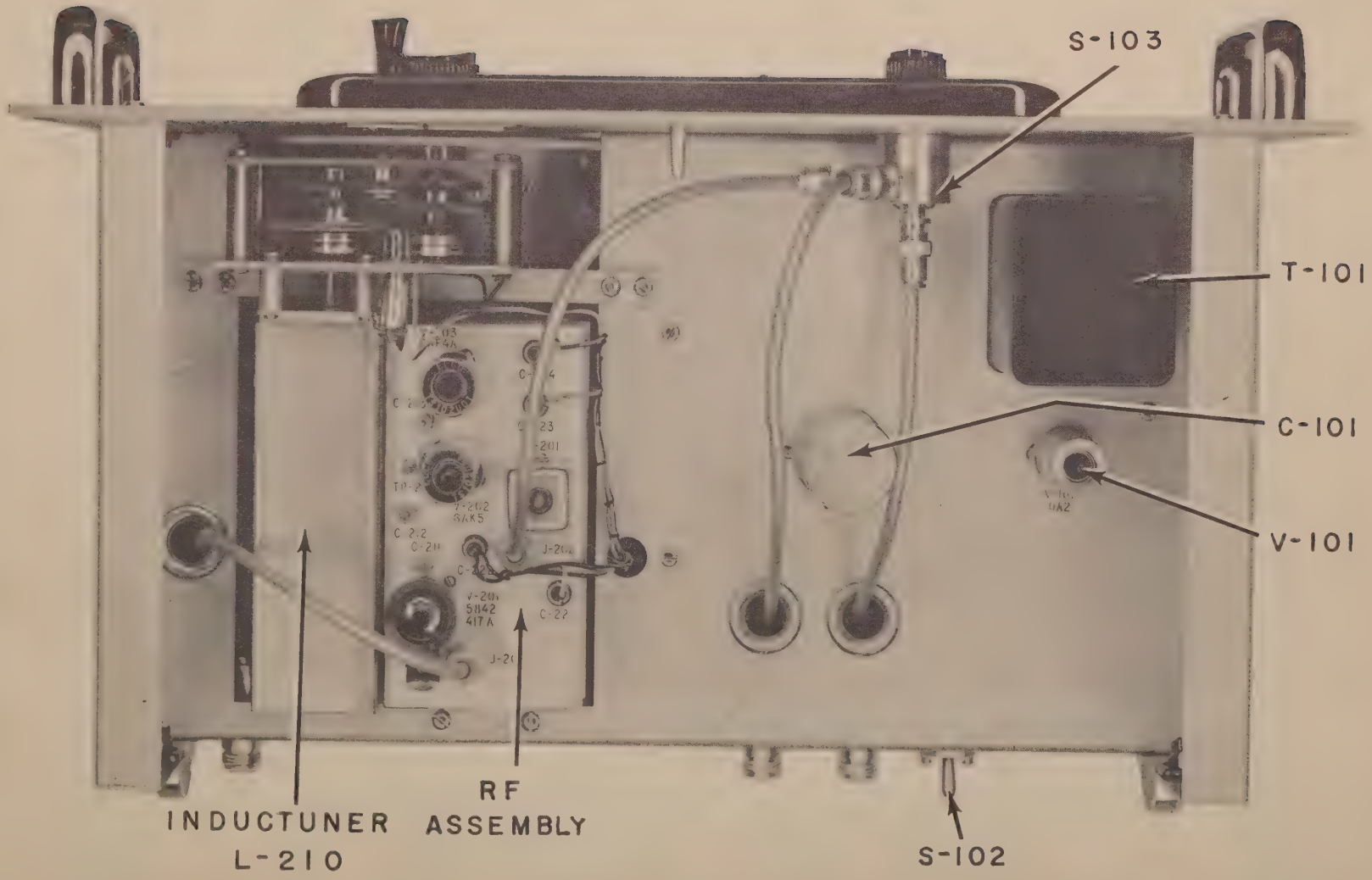
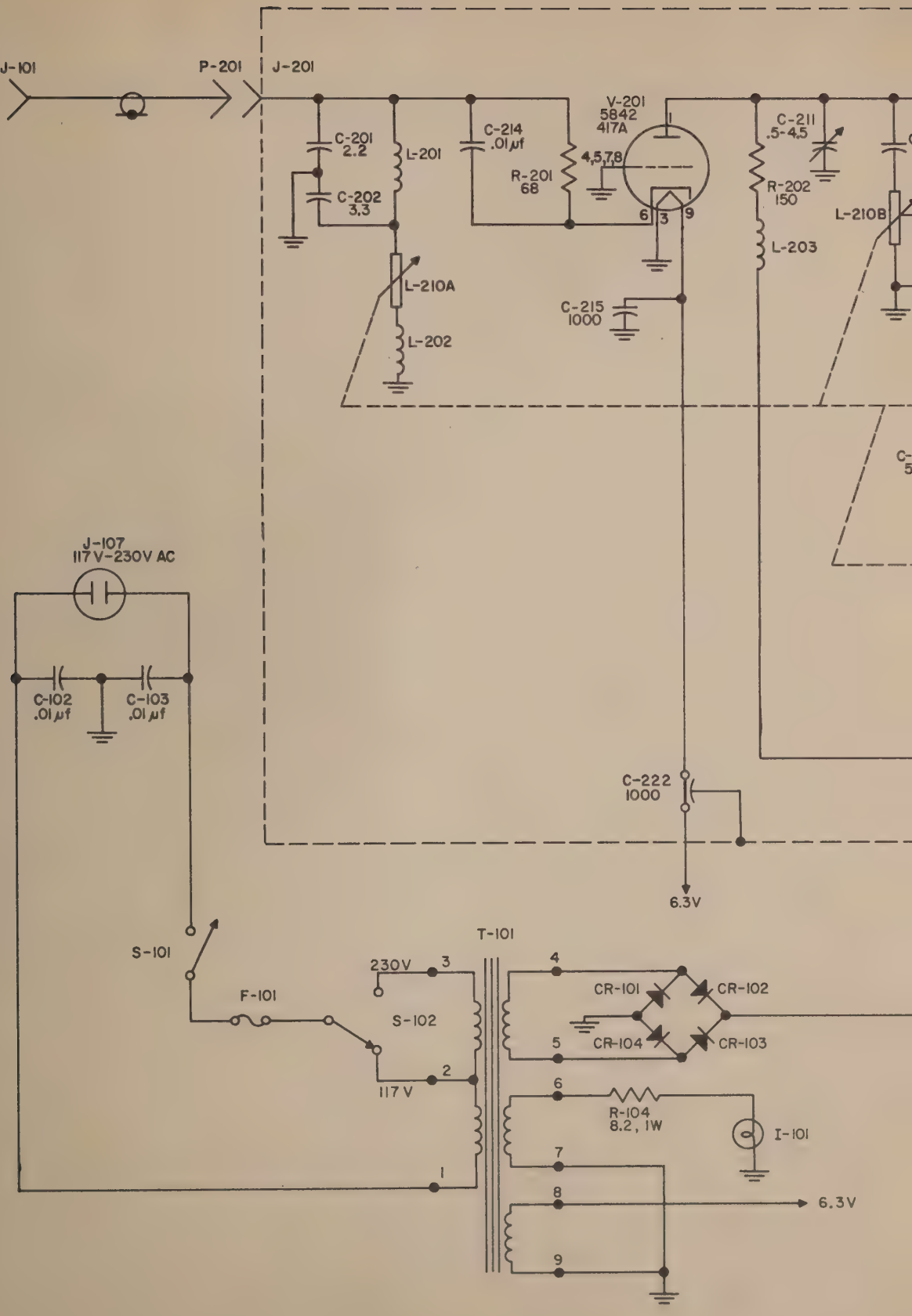
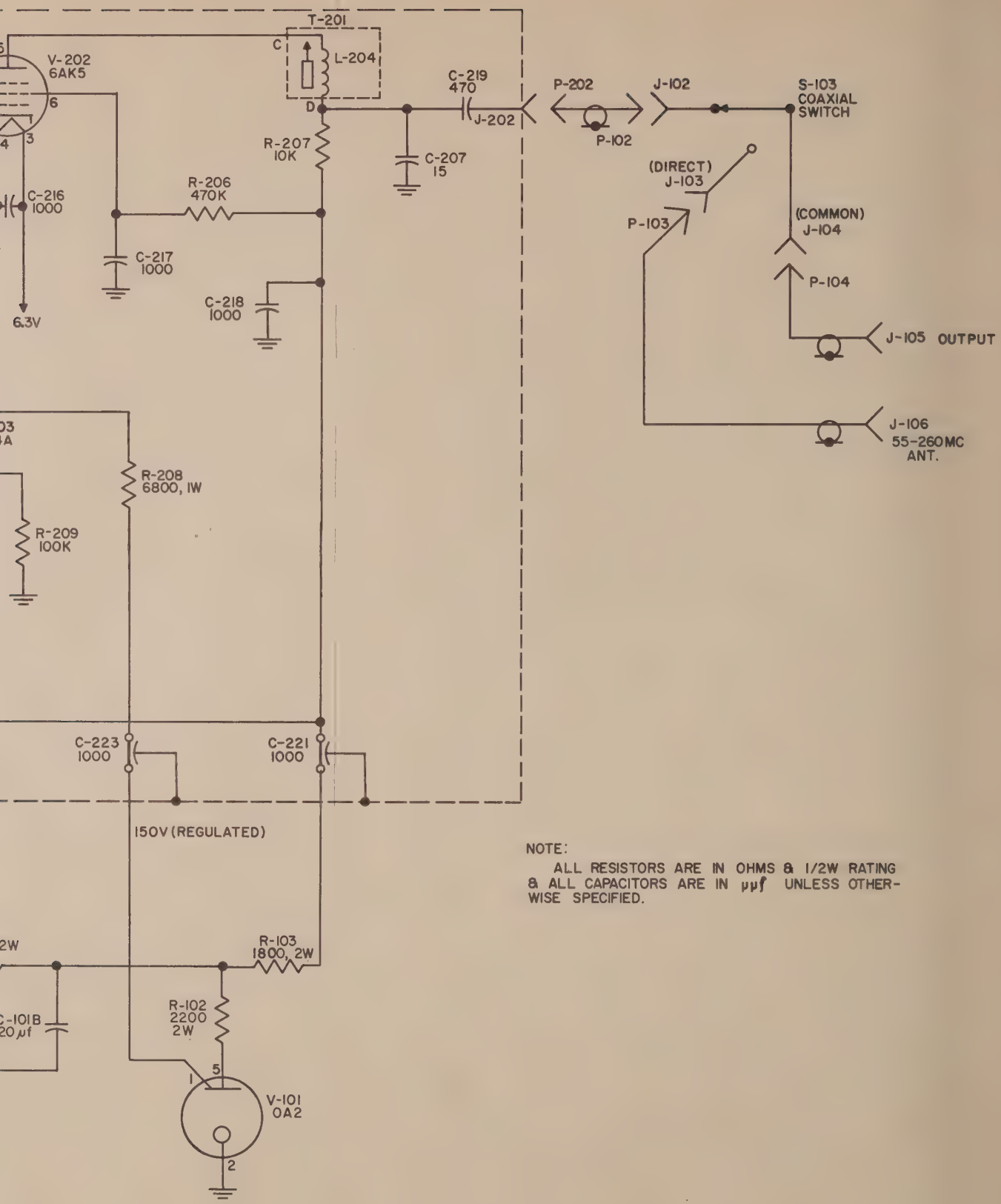


Fig. 6 Main Chassis, REU-100, Top View, Dust Cover Removed


J-101
P-201
J-201
C-201
2.2
C-202
3.3
L-201
C-214
.01 µf
R-201
68
V-201
5842
417A
4,5,7,8
6
3
9
C-211
.5-4.5
R-202
150
L-203
L-210B
L-210A
L-202
C-215
1000
C-222
1000
6.3V
J-107
117V-230V AC
C-102
.01 µf
C-103
.01 µf
S-101
F-101
T-101
230V
3
S-102
2
117 V
1
4
CR-101
CR-102
5
CR-104
CR-103
6
R-104
8.2, 1W
I-101
7
8
6.3V
9



NOTE:
ALL RESISTORS ARE IN OHMS & 1/2W RATING & ALL CAPACITORS ARE IN μμf UNLESS OTHERWISE SPECIFIED.

Fig. 7 Schematic Diagram REU-100

SECTION 5

PARTS LIST MODEL REU-100

RANGE EXTENSION UNIT

When ordering replacement parts, give the equipment name and model number, symbol number, and a description of each item ordered.

Replacement parts which will be supplied against an order may not be exact duplicates of the original parts. However, only minor differences in the electrical or mechanical characteristics will be involved, and consequently, will in no way impair the operation of the equipment.

PARTS LIST

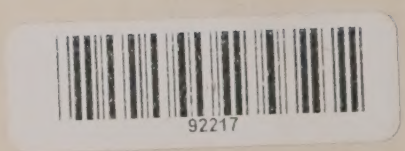
REU-100

Ref. Symbol No.	Name of Part and Description
C-101	CAPACITOR: ELECTROLYTIC, 2 section, plug in 20-20 MFD 450V, Aerovox AEP-44J
C-102	CAPACITOR; ceramic disc, .01 mfd, 500 V; Sprague 29C9B8
C-103	Same as C-102
C-201	CAPACITOR: ceramic, 2.2 mmf± .25 mmf, 500 V; Erie NPO-A
C-202	CAPACITOR: ceramic, 3.3 mmf± .25 mmf, 500 V; Erie NPO-A
C-203	CAPACITOR: ceramic, .5 mmf± .25 mmf, 500 V; Erie NPO-A
C-204	CAPACITOR: ceramic, 1.0 mmf, ±.25 mmf, 500 V; Erie NPO-A
C-205	CAPACITOR: ceramic, 3.9 mmf, ±.25 mmf, 500 V; Erie NPO-A
C-206	CAPACITOR: ceramic, 2.7 mmf, ±.25 mmf, 500 V; Erie NPO-A
C-207	CAPACITOR: ceramic, 15 mmf, ±5%, 500 V; Erie NPO-A
C-208	CAPACITOR: ceramic, 6.8 mmf, ±.25 mmf, 500 V; Erie NPO-A
C-209	CAPACITOR: ceramic, 5.6 mmf, ±.25 mmf, 500 V; Erie NPO-A
C-210	CAPACITOR: ceramic, 100 mmf, ±10%, 500 V; Erie N 1400-A
C-211	CAPACITOR: variable, tubular, ceramic .5 to 4 mmf, 500 V; Cambridge Thermionic CST-6.
C-212	Same as C-211
C-213	CAPACITOR: variable, tubular, ceramic 1.5 to 12.5 mmf, 500 V; Cambridge Thermionic CST-50
C-214	Same as C-103
C-215	CAPACITOR: ceramic disc, .001 mfd, 500 V; Sprague 40C214
C-216	Same as C-215
C-217	Same as C-215
C-218	Same as C-215
C-220	Not used
C-221	CAPACITOR: feed thru, .001 mfd, 500 V; Sprague 514C1
C-222	Same as C-221
C-223	Same as C-221
C-224	Same as C-221
F-101	FUSE: slo-blo, 3 amp, Bussman MDL
I-101	LAMP: incandescent, 6–8 V, .015 amp, GE #47
J-101	CONNECTOR: N, UG-1052/U
J-102	P/O S-103
J-103	P/O S-103
J-104	P/O S-103
J-105	Same as J-101
J-106	Same as J-101
J-107	CONNECTOR: Male, 2 contact, AC line; Hubbell #7486
J-201	CONNECTOR: BNC, UG–1094/U
J-202	Same as J-201
L-201	Strap, NEMS-CLARKE, A-18969
L-202	Strap, NEMS-CLARKE, A-18970
L-203	Coil Winding: NEMS-CLARKE, A-18974
L-204	P/O T-201

PARTS LIST

REU-100

Ref. Symbol No.	Name of Part and Description
L-205	Strap, NEMS-CLARKE, A-18971
L-206	Coil, Winding: NEMS-CLARKE, A-18973
L-207	Coil Winding: NEMS-CLARKE, A-18972-1
L-208	Coil Winding: NEMS-CLARKE, A-18972-2
L-209	Coil Winding: NEMS-CLARKE, A-18972-3
L-210A	INDUCTUNER, 4 section, VHF; Mallory 60-50309
L-210B	P/O L-210
L-210C	P/O L-210
L-210D	P/O L-210
P-101	Not used
P-102	CONNECTOR: BNC UG-88/U
P-103	Same as P-102
P-104	Same as P-102
P-201	Same as P-102
P-202	Same as P-102
R-101	RESISTOR: fixed, composition, 1000 ohms 5%, 2 W; Allen Bradley
R-102	RESISTOR: fixed, composition, 2.2 K, 5%, 2W; Allen Bradley
R-103	RESISTOR: fixed, composition, 1.8 K, 5%, 2W; Allen Bradley
R-104	RESISTOR: fixed, composition, 8.2 ohms, 10%, 1W; Allen Bradley
R-201	RESISTOR: fixed, composition, 68 ohms, 5%, 1/2 W; Allen Bradley
R-202	RESISTOR: fixed, composition, 150 ohms, 10%, 1/2 W; Allen Bradley
R-203	Not used
R-204	RESISTOR: fixed, composition, 470 K, 10%, 1/2 W; Allen Bradley
R-205	Same as R-204
R-206	Same as R-204
R-207	RESISTOR: fixed, composition, 10 K, 10%, 1/2 W; Allen Bradley
R-208	RESISTOR: fixed, composition, 6.8 K, 5%, 1 W; Allen Bradley
R-209	RESISTOR: fixed, composition, 100 K, 10%, 1/2 W; Allen Bradley
R-210	RESISTOR: fixed, composition, 680 K, 5%, 1/2 W; Allen Bradley
S-101	SWITCH: Toggle, SPST; Herman Smith #520
S-102	SWITCH: Toggle, SPDT; Herman Smith #521
S-103	SWITCH: Rotary, coaxial, 2 pos., BNC; Danbury-Knudsen CS-400
T-101	TRANSFORMER: Power, NEMS-CLARKE
T-201	TRANSFORMER: I.F.; NEMS-CLARKE
V-101	TUBE: Electron, OA2
V-201	TUBE: Electron, 5842
V-202	TUBE: Electron, 6AK5
V-203	TUBE: Electron, 6AF4A
W-101	POWER CORD ASSEMBLY: (w/connector #7484 Hubbell) Cornish #3510
XF-101	FUSEHOLDER: Bussman H.K.P.
XI-101	LAMP ASSEMBLY: min, bayonet; Drake #219-236U32AH
XV-101	Socket, tube, 7 pin min; TS-102P01
XC-102	Socket, tube, Octal; TS-101P01
XV-201	Socket, tube, 9 pin min; Mycalex 90 A 299
XV-202	Socket, tube, 7 pin min; Mycalex 70 A 403
XV-203	Same as XV-202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